

700 MATERIAL DETAILS

Materials shall conform to the stated requirements and/or the requirements of the referenced specifications including modifications as noted.

Copies of all Supplemental Specifications referenced in this section are on file with the City of Columbus Transportation Division.

711 - STRUCTURAL STEEL AND STRUCTURE INCIDENTALS

711.01 Structural Steel. Steel shall be structural steel ASTM A 36, or when specifically called for high-strength low alloy steel ASTM A 572, Grades 42 through 50, or A 588.

Material designated to meet notch toughness requirements shall have a minimum longitudinal Charpy V-notch (CVN) energy absorption value as listed below. Sampling and testing procedures shall be in accordance with ASTM A 673. The (H) frequency of heat testing shall be used, and the test data shall be provided as required by 501.07.

ASTM Designation	Thickness and Connection Method	Min CVN Value
A 36	Up to 4" (102 mm) mechanically fastened or welded	15 ft. lb. (20 J) @ 40° F (4° C)
A 572, A 588	Up to 4" (102 mm) mechanically fastened	15 ft. lb. (20 J) @ 40° F (4° C)*
A 572, A 588	Over 2" to 4" (50 to 102 mm) welded	20 ft. lb. (27 J) @ 40° F (4° C)*
A 572, A 588	Up to 2 " (50 mm) welded	15 ft. lb. (20 J) @ 40° F (4° C)

* If yield point of the material exceeds 65 ksi (488 MPa), the temperature of the CVN value for acceptability should be reduced by 15° F (8.3° C) for each increment, or part of increment, of 10 ksi (69 MPa) above 65 ksi (448 MPa).

711.02 Galvanized Steel. Steel shall be galvanized to conform to ASTM A 123 after cutting, bending and welding. At the discretion of the Engineer, damaged galvanized material shall be replaced, regalvanized or repaired. If a repair is authorized, the method shall be acceptable to the Engineer.

Bolts, nuts, washers and similar threaded fasteners shall be galvanized in accordance with ASTM A 153. These items may be mechanically zinc coated in accordance with ASTM B 695, Class 50. Except for ASTM A 325 Bolts, electro-galvanizing may also be accepted if the coated item meets the thickness coating requirements above.

All galvanized parts that are to be embedded in fresh concrete except chairs for reinforcing bar support shall be given a chromate treatment in accordance with the American Hot Dip Galvanizers Association, Inc., recommendations. The galvanizer shall furnish a certification for each lot of chromate treated steel.

711.03 Steel for Sheet Piling. ASTM A 328.

711.04 Cold Rolled Steel. ASTM A 108, Grade 1016 through 1030 for pins, rollers, trunnions and other similar parts.

711.07 Steel Castings. ASTM A 486, Class 70 or ASTM A 27, Grade 65-35 or Grade 70-36 with the following additions:

Steel castings shall be free from pouring faults, sponginess, cracks, blow holes, and other defects in positions affecting their strength and value for the service intended. No sharp, unfilleted angles or corners will be allowed.

711.08 Arc-Welding Electrodes and Fluxes. The following applies except for exposed bare ASTM A242 and A588 steels. See Table 711.08-1 for exposed bare ASTM A242 and A588 applications.

1. Manual shielded metal-arc welding.
 - A. AWS A5.1 Low Hydrogen only.
 - B. AWS A5.5 Low Hydrogen only.
2. Submerged arc welding.
 - A. AWS 5.175.
 - B. AWS 5.235.
3. Gas metal-arc welding, AWS A5.185.
4. Flux cored arc welding, AWS A5.205.

(Table 711.08-1)

Filler metal requirements for exposed bare applications of ASTM A242 and A588 steel.

Welding Process

Shielded	Submerged	Gas Metal Arc or
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Metal Arc	Arc	Flux Cored Arc 2,4
AWS A5.5	AWS A5.23	AWS A5.185
E8016 or 18-G1,2	F7X-EXXX-W2,3	AWS A5.205
E8016 or 18-B12	F7X-EXXX-B12,3	AWS A5.285
E8016 or 18-B22	F7X-EXXX-B22,3	AWS A5.295
E8015 or 18-B2L2		62 ksi min YP
E8016 or 18-C1	F7X-EXXX-Ni13	(430 M Pa)
E8016 or 18-C2	F7X-EXXX-Ni23	72 ksi min TS
E8016 or 18-C3	F7X-EXXX-Ni33	(495 M Pa)
	Elon 18% min	

1. Deposited weld metal shall have the following chemical composition: C, max %, 0.12; Mn, %, 0.50/1.30; P, max %, 0.03; S, max %, 0.04; Si, %, 0.35/0.80; Cu, %, 0.30/0.75; Ni, %, 0.40/0.80; Cr, %, 0.45/0.70.
2. Deposited weld metal shall have a minimum impact strength of Charpy V-notch 20 ft/lb (27.1 J) at 0° F (-18° C) (only applied to bridges).
3. The use of the same type filler metal having next higher mechanical properties as listed in AWS specification is permitted.
4. Deposited weld metal shall have a chemical composition the same as that for any one of the weld metals in this table for the shielded metal arc welding process.
5. In conformance with those classifications allowed under AWS D1.5 1988 Bridge Welding Code, Tables 4.1 and 4.2.

The ODOT Laboratory will issue a list of approved electrodes and combinations of shielding. Electrodes will be included in the list where certified test data have been submitted by the manufacturer and found in compliance with the specified requirements. The certification may cover either process qualification or quality control tests. To qualify, such tests must be made within one year preceding the period covered. Each submission of certified test data shall include the manufacturer's statement that he will advise the Laboratory immediately of any change in materials or processing used in the manufacture of the electrodes made within one year from the date of the tests.

When electrodes to be used are not included in the ODOT Laboratory's list of approved electrodes and combinations of shielding, certified test data showing compliance with the specified requirements shall be submitted as described above for each lot.

711.09 High-Strength Steel Bolts, Nuts and Washers. ASTM A 325 with the following exceptions:

Inspection 11. Inspection shall be done at the project site. Random samples shall be obtained from material delivered to the project site or at other locations designated by the ODOT Laboratory.

Bolts for steel use in bare unpainted applications shall be ASTM A 325, Type 3.

When galvanized bolts, nuts and washers are specified, they may be mechanically galvanized.

Bolts used to fasten steel painted according to 514 System A shall be galvanized and need not be painted.

711.10 Machine Bolts. ASTM A 307 with the following exception:

Inspection 11. Inspection shall be done at the project site. Random samples shall be obtained from material delivered to the project site or at other locations designated by the Laboratory.

Mechanical galvanizing is permitted.

711.12 Gray Iron Castings. ASTM A 48, Class 30B, with the following exceptions:

Number of Tests and Retests 11. (a) Two or more test bars shall accompany each lot of castings or; one pair of test bars may represent castings shipped to two or more projects provided the lot number or date cast are cast in both the bars and castings or such identification shall be anchored in the castings and test bars. The identifying data on castings shall not interfere with the use of the casting.

Workmanship and Finish 15. In addition, the castings shall be free from pouring faults, sponginess, cracks, blow holes, and other defects in positions affecting their strength and value for the service intended. They shall be generously filleted at angles and the arises shall be sharp and perfect.

Inspection 17. Inspection shall be made at the project site. Test bars representing the lot shall be made available to the Laboratory at the place of manufacture or warehouse from the lot to be shipped or shall accompany the lot shipped.

711.13 Ductile Iron Castings. ASTM A 536, with the following additions and exceptions:

Workmanship and Finish 10.1. In addition, the castings shall be free from pouring faults, sponginess, cracks, blow holes, and other defects in positions affecting their strength. They shall be generously filleted at angles and arises shall be sharp and perfect.

Number of Tests 11.1. A keel block or Y-block specimen made in accordance with A 536 shall accompany the shipment for each heat number, ladle number and date of casting.

Inspection 12.1. Inspection shall be made at the project site.

Certification 14.1. Test bars shipped with castings shall be accompanied by a certification stating the bars were prepared in accordance with specified requirements.

711.15 Sheet Copper. ASTM B 370.

711.16 Phosphor Bronze Plate. ASTM B 100.

711.17 Cast Bronze. ASTM B 22, Copper Alloy No. C91100 with the following addition:

The cast plate shall be finished to plane surfaces and one plate of a pair shall be finished at right angles to the other plate of the pair.

711.18 Leaded Bronze. ASTM B 584, Copper Alloy No. C93700 with the following addition:

The cast plate shall be finished to plane surfaces and one plate of a pair shall be finished at right angles to the other plate of the pair.

711.19 Sheet Lead. ASTM B 29.

711.20 Aluminum for Railings.

1. Aluminum other than permanent mold castings shall conform to the following requirements:

American Society			
Portion for Testing Materials			
of			
Railing	Designation	Alloy or Temper	Condition
		(B296)	
Sand castings	B 26	356.0	T6
Shims	B 209	1100	0
Washers	B 209	Clad 2024	T4
		6061	T6

Sheet and plate	B 209	6061	T6
Drawn seamless tubes	B 210	6061 or 6063	T6
Bars, rods, wire	B 211	6061	T6
Bolts, set screws	B 211	2024*	T4
	6061	T6	
Nuts	B 211	6061	T6
	6262	T9	
Extruded bars, rods, shapes	B 221	6061 or 6063	T6
	6351	T5	
Extruded tubes	B 221	6061 or 6063	T6
	6351	T5	
Pipe B 241	6061 or 6063	T6	
Rivets B 316	6061	T6	

*Shall have an anodic coating.

Permanent mold cast aluminum for bridge railing posts shall comply with the requirements of AASHTO M 193.

711.21 Preformed Bearing Pads. Composition. Preformed bearing pads shall consist of a fabric and rubber body. The pad shall be made with new, unvulcanized, natural and/or synthetic rubber and unused cotton and/or synthetic fabric fibers in proper proportion to maintain strength and stability.

Physical Properties. The surface hardness expressed in standard rubber hardness figures shall be 80+10 Shore Durometer. The ultimate break down limit of pads under compressive loading shall not be less than 10,000 pounds per square inch (69 MPa). The pads shall be furnished to specified dimensions and all bolt holes accurately located and cleanly cut.

711.23 Elastomeric Bearings. Bearing pads and elastomeric bearings shall comply with Articles 25.5 through 25.8 of Section 25, Elastomeric Bearings, Division II, Construction, of the AASHTO Standard Specifications for Highway Bridges. Acceptance of the pads and bearings shall be according to Level I acceptance criteria of Article 25.7. The testing shall be included in the price bid for the bearings.

Bearing pads and laminated bearings shall be of the compound known as neoprene and shall be cast in molds under pressure and heat. A plain elastomeric bearing pad and steel load distribution plate combination shall be classified as a laminated elastomeric bearing. Test specimens shall be in accordance with ASTM D 3182 or D 3183. Where test specimens are cut from the finished product, a 20 percent variation from the original

physical properties is allowed. Compound of nominal hardness between the values shown in the following table may be used and the test requirements interpolated.

	Grade		
Physical Properties	50	60	70
Original Physical Properties:			
Hardness, Durometer A,			
ASTM D 2240	50 + 5	60 + 5	70 + 5
Tensile Strength,			
min psi (MPa), ASTM D 412	2,500 (17)	2,500 (17)	2,500 (17)
Elongation at break,			
min %	400	350	300
Accelerated Test to Determine Long-Term Aging Characteristics, Oven-aged 70 hrs/212° F (100° C), ASTM D 573:			
Hardness, points			
change, max	+15	+15	+15
	50	60	70
Tensile strength,			
% change, max	-15	-15	-15
Elongation at break,			
% change, max	-40	-40	-40
Ozone-1 ppm in air by volume-20% strain-104° F (40° C)-ASTM D 1149, 100 hrs	No cracks	No cracks	No cracks
(Samples to be solvent wiped before test to remove any traces of surface impurities)			
Compression set-22 hrs/212° F (100° C)-ASTM D 395,			
Method B, % max	35	35	35
Adhesion, bond made			

during vulcanization-			
ASTM D 429,			
Method B, lbs/in (kN/m)	40 (7)	40 (7)	40 (7)

Bearing pads may be molded individually, cut from previously molded strips or slabs or extruded and cut to length. Laminated bearings shall be molded together into an integral unit with all edges of internal steel laminates covered by a 1/8-inch (3.0 mm) minimum thickness of elastomer. Indentations or grooves on the exterior surface of the bearings caused by external laminate restraining devices shall be filled to a 1/8-inch (3.0 mm) minimum cover by a revulcanized patch; or by a silicone caulk conforming to Federal Specifications TTS-001543A; or by and approved equal. The patching shall be done by the bearing manufacturer.

The external connection or distribution plates of laminated bearings shall be the same material as the attached structural steel and be similarly cleaned and coated; internal plates shall be ASTM A 36 or A 570, Grade 36 or Grade 40. All plates shall be deburred. The internal plates shall not be less than 0.074 inch thick (1.9 mm).

The manufacturer shall furnish certified test data for the elastomer, base plate, steel laminates and proof load. The manufacturer shall supply a sample bearing of each design, as shown in the plans, for destructive testing for approval purposes.

711.24 Waterproofing Fabric. AASHTO M 117.

711.26 Structural Timber, Lumber and Piling. AASHTO M 168 with the following additions:

Timber and lumber shall be air dried or kiln dried to a moisture content not to exceed 19 percent by weight. Size and grade shall conform to American Lumber Standards.

All structural timber, lumber, and piling originating within the State of Ohio shall be subject to inspection by an authorized inspector of the Department.

All untreated lumber originating outside the State of Ohio shall bear the Association Grade Mark of a Regional Association of Lumber Manufacturers.

All untreated lumber originating outside the State of Ohio shall be graded under the rules of one of the following associations:

1. West Coast Lumber Inspection Bureau.
2. Western Wood Products Association.
3. Southern Pine Inspection Bureau.

4. Northern Hardwood and Pine Manufacturers Association.

The untreated lumber shall be graded by and bear the mark of an agency certified for grading under the rules of one of the above associations. The Laboratory has a listing of approved agencies.

All treated timber and lumber except piling, guardrail posts, fence posts, braces, and spacer blocks originating outside the State of Ohio shall be certified before treatment as to grade, specie, and grading agency by the following means:

- (a) A certificate of inspection from an approved grading agency, and
- (b) A mark of identification on one end of each piece indicating grading agency, grade and producer. Such identification is to be applied by the manufacturer producing the material.

711.27 Prestressing Steel. ASTM A 416 with the following exception:

11. Inspection. Sampling and inspection as directed by the Laboratory.

711.28 Cellular Polyvinyl Chloride Sponge. Cellular polyvinyl chloride sponge shall meet the requirements of AASHTO M 153, Type I except the density of the PVC sponge shall be not less than 20 pounds per cubic foot (320 kg/m³).

711.30 Aluminum for Steps. ASTM B 221, Alloys 6061-T6 or 6005-T5.

711.31 Reinforced Propylene Plastic Manhole Steps. Steps shall conform substantially with details shown on the plans. Steel rod shall be continuous through the entire length of legs and tread.

Steel shall conform to the requirements of 709.01, Grade 60.

Propylene plastic shall conform to ASTM D 2146, Type II, Class 16906 or Class 43758. The manufacturer shall furnish certified test data for the propylene plastic used in each lot of steps.